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Does Aid Improve Public Service Delivery?

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Abstract

The expected increase in aid to Africa will put a big challenge for public service delivery. Using a simultaneous equation model, this paper provides an analysis of the effects of the volume and volatility of aid on education, health, water and sanitation outcomes, taking also into account the institutions related to public service delivery, including freedom of press, corruption and decentralization. Overall, the share of official development assistance (ODA) that is provided for education and health seems to have a positive impact on the outcomes in these sectors, whereas total aid seems to be negatively associated. Aid volatility is associated with better outcomes in sanitation, water and infant mortality, contrary to expectations.

Keywords: public expenditure, aid, education, health, water, sanitation, Africa

JEL classification: H4, H5, H7, I1, I2, L9, O2

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Acronyms

DAC Development Assistance Committee (of the OECD)

ODA official development assistance

MDGs Millennium Development Goals

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1 Introduction

Sub-Saharan Africa in general is not on track for meeting the Millennium Development Goals (MDGs) by 2015. Thus a doubling of aid in general and specifically to Africa was agreed at the G-8 summit in 2005 in order to substantially improve the delivery of government services and investments in infrastructure. Increased aid and debt relief are expected to boost government spending to improve health, education and infrastructure, which are perceived as the classical tasks of the state.

Of the eight MDGs two are related to education, three to health and one to water and sanitation, one important part of infrastructure.[1] On current trends most regions will fall short on the goals for reducing child and maternity mortality, and the number of people infected with HIV/AIDS continues to grow. The goals of universal primary education and of gender equality in primary and secondary education will not be met in three of the six developing regions. In Africa the situation is even bleaker. Although primary school enrolment has increased rapidly, this has not sufficiently translated into higher completion rates. Likewise the reduction of child mortality and the increase in access to water and sanitation have been slow (UNECA 2005).

Thus, to reach these MDGs, improved service delivery in education and health as well as investment in water and sanitation is needed. It is estimated that to reach the health related MDGs, Sub-Saharan Africa needs to triple its health workforce, adding more than one million workers. To reach universal primary education the current stock of teachers has to increase by almost 20 per cent each year. On average, budget allocations do not reach the benchmark of 20 per cent of government budget earmarked for education and 15 per cent for health, also indicating a need for an increase in public expenditure (WB/IMF 2005; UNECA 2005).[2] However, to reach the MDGs it is not sufficient to increase spending for public service delivery but its efficiency also needs to be improved. The question is thus how to boost service delivery and maintain a larger stock of related investment in a sustainable way, so that it can be ultimately financed from domestic resources.

The expected increase in aid will be a big challenge for service delivery. As the efficiency of resource spending depends not only on the capacities and characteristics of the recipient country but also on the quality of aid in terms of predictability, consistency with recipients priorities and donor coordination, the main focus of this paper is on the effects of the volume and volatility of aid. In addition, the institutions related to public service delivery are taken into account.

After a short overview of aid flows to Africa and the current state of service delivery in the region, the potential effects of public expenditure and aid on the quantity and quality

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1 Goal 2: Achieve universal primary education;
Goal 3/Target 4: Eliminate gender inequality in primary and secondary education;
Goal 4: Reduce child mortality;
Goal 5: Improve maternal health;
Goal 6: Combat HIV/AIDS, malaria, and other diseases;
Goal 7/Target 2: Halve the proportion of people without sustainable access to safe drinking water and basic sanitation.

2 These targets were agreed under the Education for All Fast Track Initiative and the Abuja Declaration, signed in 2002.

of service delivery in education, health and water and sanitation are discussed. As the problems with service delivery and the share of aid in public expenditure are higher in Africa than in other regions, the following discussion focuses on Africa but is also relevant for other low-income countries. A simultaneous equation model for estimating the determinants of service delivery is presented and the results are discussed before concluding.

2 Recent developments in aid and public service delivery

After a decline in the 1990s, official development assistance (ODA) to Africa has been increasing again since 2002.[3] This trend is expected to continue after the promises made by the G-8 in Gleneagles in 2005. With respect to the sectoral distribution the largest percentage of ODA to Africa in 2001-02 went to social infrastructure and services (36 per cent), including education and health. Another important sector is economic infrastructure and services (14 per cent) that include water, transport and energy. Together with support for production (9 per cent) this is expected not only to reduce the financing gap but also contribute to future growth perspectives (OECD 2005). Increasingly, ODA is given in the form of budget support instead of project and programme aid, making its use more flexible for recipients and reducing the problems of tied aid.[4]

In many African countries a large share of public investment in infrastructure and social expenditure (especially for education and health) is financed by aid, making these crucial sectors vulnerable to aid volatility (World Bank/IMF 2005). Aid volatility is

Table 1
Summary statistics on public service delivery outcomes and ODA per sector, 2002

	Africa	Other developing
Mortality rate, infant (per 1,000 live births)	86.66	32.35
Mortality rate, under-5 (per 1,000)	136.29	41.34
Literacy rate, youth total (% of people aged 15-24)	77.38	93.36
Primary completion rate, total (% of relevant age group)	61.02	91.60
Improved sanitation facilities (% of population with access)	40.90	69.95
Improved water source (% of population with access)	66.26	83.83
ODA commitments for education (% of total ODA)	9.56	8.09
ODA commitments for health (% of total ODA)	5.24	4.46
ODA commitments for water and sanitation (% of total ODA)	2.91	5.11

Note: Averages are weighted.

Source: World Bank (2005) and OECD (2006).

3 ODA consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions and by non-DAC countries to promote economic development and welfare in recipient countries. They include matching grants for debt relief (World Bank 2005).

4 Tied aid means that at least part of the amount received has to be spent by purchasing goods and services from the donor country. This reduces the efficiency of aid.

higher and has more negative effects for countries that depend heavily on aid (Bulíř and Hamann 2003). With US$26 of net ODA per capita in 2002, Africa receives more than double the amount per inhabitant than the average of all ODA recipients (OECD 2005). But whereas in African countries a higher share of ODA is on average directed towards education and health, the outcomes in these sectors are worse than in other regions. By contrast, for water and sanitation African countries receive a lower share of ODA, which is in line with the less favourable outcomes (Table 1).

3 Public expenditure, aid and the quality of service delivery

Aid, in principle, makes more money available for public spending on health, education and water and sanitation, which in turn should improve service delivery. But it might also create significant challenges for recipient countries with respect to the management of resources and dependency on volatile flows. Many studies find diminishing returns of aid on growth, which might also apply to service delivery. In the following, first the general effects of increasing public expenditure are discussed followed by a discussion of the effects of aid.

In general, the empirical evidence that more public expenditure might lead to better quality public services is weak. A number of studies show that the effect of public spending for education and educational attainment is low and that it is rather influenced by other variables such as per capita income, the age distribution of the population or parental education. The picture is more mixed for the effect of public spending on health on health outcomes, with some studies finding that the effect is not significant while others find a positive contribution (Gupta, Verhoeven and Tiongson 1999; World Bank/IMF 2005). In the provision of water and sewerage services higher spending might also not lead to a proportional increase in the quality of service delivery as leakages are quite high (Briceno-Garmendia, Estache and Shafik 2004).

The efficiency of service delivery is greatly influenced by the use of funds for different types of expenditure like wages, construction or physical inputs. The allocation of resources in turn depends on the quality of governance. In the case of education, the weak link between expenditure and results can be explained by the fact that the cost effectiveness of different measures varies widely. Whereas the provision of textbooks is relatively cheap and effective, a reduction of student teacher ratios is relatively expensive and of limited effect below a threshold of 60 students per class. In addition, the distribution of resources plays a big role. If every second child in each class has a textbook, student achievements are almost as high as with individual books. Hence, an equal distribution of books across schools and classes will result in much higher achievements than a skewed distribution of all books to a limited number of privileged schools (Michaelowa and Wechtler 2006). Likewise, in the provision of health services, the expansion of hospitals does have less impact on child mortality rates than allocation on immunization programmes and malaria control.

In addition, the number of people involved in decisionmaking and service delivery and the dependency on the discretionary behaviour of individuals provide opportunities for the leakage of funds. Furthermore the difficult working conditions and uncompetitive salaries can reduce the accountability of service provision, fostering absenteeism and low quality (World Bank/IMF 2005).

Therefore, an increase in public expenditure is likely to increase outcomes only if institutions are in place to ensure the efficient use of resources. Large variations in the record of governments in delivering public services and reducing poverty often can be attributed to differences in the incentives for politicians to allocate public resources. Such misallocations can be traced to constraints on the extent to which poor people can hold governments accountable, such as lack of information about service quality, lack of credibility of political promises, and polarization of voters on social and ideological grounds. Greater political accountability improves public services and reduces corruption. For example, transparency in Uganda with respect to government transfers to local spending units has reduced leakage of those funds by as much as 90 per cent (World Bank 2003).

One recent trend aimed at increasing participation and transparency in public service delivery is decentralization. While decentralization may lead to greater accountability and hence to increased prospects that services would reach targeted groups, the possibility of the local elite capturing the services suggests that decentralization is not a panacea. There is evidence that decentralization might only reduce poverty through better targeting of service delivery in countries with sufficient capacity and willingness of policymakers to ensure a pro-poor development process. Thus strengthening the institutional capability at the local level is essential if decentralization is to be effective. In addition, improving service delivery requires strengthening the relationships of accountability among policymakers, service providers, and users (Jütting et al. 2004; World Bank 2003).

It has to be noted that in most developing countries a large share of expenditure for health, education and water and sanitation comes from private sources, mainly out of pocket payments. In many African countries, private expenditure for health is higher than public expenditure, for example in Morocco it is 3.4 per cent of GDP versus 1.7 per cent of GDP for public health expenditure. Even in very poor countries like Burkina Faso private health expenditure is higher (3.0 per cent of GDP) than public spending (2.6 per cent of GDP). In addition, there are private providers of services and infrastructure including NGOs. Direct payments for water are especially high for the poor. In Uganda water payments account for 22 per cent of the average income of urban households in the poorest 20 per cent of the income distribution (UNDP 2006).

Especially in low-income countries a large part of public expenditure for education, health and water and sanitation is financed through aid. For example aid commitments amounted to 42 per cent of public expenditure for health in 2003, although not all of this aid is channelled through government budgets (High-Level Forum on the Health MDGs 2005). In general, aid does increase public expenditure but the relationship is less than one to one. One explanation is that aid is partly used for tax relief but there is also evidence that governments do not receive all aid flows reported by donors, as some aid is spent, for example, on consultants from donor countries (Mackinnon 2003). Countries becoming heavily dependent on aid can create significant problems. Lewis (2005) finds in the case of HIV/AIDS programmes that aid dependency can lead to reduced incentives to mobilize domestic resources, shift of priorities towards donor interests, less concern about inefficiency in service delivery, and a potential for increased corruption and rent seeking. In addition, aid might disturb the coherence of recipient-government decisions because of differing interests between donors and recipients and information asymmetries (Mackinnon 2003). Thus efforts to improve

governance through fighting corruption, for example, might increase aid effectiveness considerably.

One fundamental problem of increased public expenditure through aid as a big push is the absorptive capacity of the recipient country. The ministries charged with managing the delivery of services could face significant organizational challenges, when they need to administer much higher budgets. The increased public expenditure through aid inflows might also drive up the costs of public service delivery and construction and can increase the shortage of qualified personnel in the private sector (Mackinnon 2003). In addition, aid is strongly pro-cyclical, so it cannot be used to compensate for reduced government revenue (Mackinnon 2003).

The composition of expenditure financed by aid might change with the scale of the task. For example, two-thirds of aid for education is currently provided in the form of technical assistance, even though the bulk of expenditure is on local personnel. There is evidence that the number of workers in health and education services is correlated with coverage. In addition, wages especially for skilled professionals have to increase to reduce migration and braindrain. Hence, if increased aid does not also cover personnel and operational costs, it is likely that the quality of service delivery will decline (World Bank/IMF 2005).

Both higher aid and the associated higher volatility are likely to pose a significant burden on the planning capacities of countries. The recent literature on the effects of aid volatility and predictability has focused on its negative relation with growth. Aid volatility is likely to affect the determinants of growth, such as investment, government revenue and expenditure. The instability of aid disbursements may alter fiscal behaviour, possibly causing a decrease in public investment (Lensink and Morrissey 2000). There is also empirical evidence that a permanent flow of aid finances mainly consumption, whereas shocks to aid result in fluctuations of investment (Arellano et al. 2005). Furthermore, the volatility of programme aid is higher than that of project assistance. As the latter is designed to promote investment in physical and human capital, its volatility is likely to have more severe negative effects on long-term development (Fielding and Mavrotas 2005).[5] Other evidence shows that volatility of aid targeted to productive public spending reduces the positive growth effect, whereas volatility of aid for non-productive use is growth enhancing (Neanidis and Varvarigos 2005). Although to my knowledge there are no studies that analyse the link between aid volatility and service delivery, it is likely that service delivery is one of the channels through which aid volatility affects growth. Specifically, a negative correlation between aid volatility and volatility in public expenditure for health has been noted (High-Level Forum on the Health MDGs 2005).

One strategy to cope with uncertainty of future aid flows is to make expenditure more flexible. Ministries must decide whether to employ more civil servants or whether to outsource service delivery. This decision has to take into account the efficiency of service delivery but also the minimization of risks from aid volatility (Heller 2005). For example in primary education a trend towards contract teachers, who are no longer civil servants but are employed on the basis of fixed-term contracts, is observable. These contracts are employed both by the government at different levels and by parent groups,

[5] Aid volatility is measured by shocks to aid in the paper by Fielding and Mavrotas (2005).

mainly in cases where no public schools exist. In a sample of eleven francophone African countries, Michaelowa and Wechtler (2006) find that privately employed contract primary teachers account on average for 29 per cent of all teachers, whereas publicly employed contract teachers account for 20 per cent and civil servants only for 51 per cent. As publicly employed contract teachers earn less than half of their civil servant peers, this trend has facilitated the boost of primary enrolment at relatively low costs. Although the contract teachers have a lower level of professional training and less favourable working conditions, no negative effect on student performance has been noted, probably due to a different incentive structure as further employment prospects depend on performance and parent satisfaction (Michaelowa and Wechtler 2006).

These findings from existing literature support the hypothesis that the effectiveness of aid with respect to public service delivery might depend on institutional factors and that aid volatility might reduce the returns to aid. An increase in public expenditure, be it through aid or other revenue, will increase the scope and quality of service delivery mainly when institutions are in place that set the right incentives for efficient resource allocation.

4 Data and methodology

In this paper we look at the determinants of outcomes in the areas of water and sanitation, health and education simultaneously, as it is assumed that outcomes in one area will also affect outcomes in other areas. For example improved access to sanitation will reduce the spread of infectious diseases. In fact, expanding water and sanitation services is perceived as one of the most cost-effective strategies for improving health outcomes. Inadequate access to clean water means that girls have to spend a lot of their time collecting water thus limiting their time to go to school.[6] In addition, education—especially of women—has a positive effect on the health of their children and measures that are meant to improve education, such as school feeding and deworming, will have an impact on malnutrition and thus health. There is less evidence that outcomes in health or education will directly affect the provision of water and sanitation (World Bank/IMF 2005; WHO and UNICEF 2006; UNDP 2006).

The public service delivery production functions are structured as follows:

$$H_i = f(E_i, I_i, SH_i, X_i) \quad (1)$$

$$E_i = f(H_i, I_i, SE_i, Y_i) \quad (2)$$

$$I_i = f(SI_i, Z_i) \quad (3)$$

where H_i is a health outcome for a country i, which is a function of education and water and sanitation outcomes E_i and I_i, and of a set of variables that capture public spending and aid for health SH_i, as well as a number of socio-economic variables, summarized in

6 However, this finding is mainly based on household studies in a limited number of countries. In addition the effects of water on health vary by type of provision of water and sanitation, which is not captured in the country data available (UNDP 2006).

vector X_i. Likewise education outcome is a function of health and water and sanitation outcomes as well as of public spending and aid to these areas SE_i and several socio-economic variables Y_i. Finally, water and sanitation outcome is a function of aid SI_i and several socio-economic variables Z_i. These socio-economic variables can differ between the three equations and will be elaborated below.

The functional form of the three equations is assumed to be similar to the health and education production functions used by Rajkumar and Swaroop (2002):

$$\text{Outcome}_i = eA_i \left[\frac{\text{PubExp}_i}{N_i}\right]^{\alpha} * \left[\frac{\text{Aid}_i}{\text{GNI}_i}\right]^{\beta} * \left[\frac{\text{Aid to sector}_i}{\text{Aid}_i}\right]^{\gamma} \quad (4)$$

With Outcome being the outcome in water and sanitation, health or education, PubExp the public expenditure in the respective sector, N the population size or number of students in the case of education, Aid is total ODA and Aid to sector the amount of sector specific aid. Taking logs Equation (3) can be written as:

$$\ln(\text{Outcome}_i) = A_i + \alpha \ln\left[\frac{\text{PubExp}_i}{N_i}\right] + \beta \ln\left[\frac{\text{Aid}_i}{\text{GNI}_i}\right] + \gamma \ln\left[\frac{\text{Aid to sector}_i}{\text{Aid}_i}\right] \quad (5)$$

To be able to estimate this system of equations the reduced form of Equation (1) has to be derived through replacement of E_i with Equation (2). Thus health outcomes are a function of water and sanitation outcomes, determinants of health outcomes and determinants of education outcomes. For the estimation of the system, first Equation (3) was used as water and sanitation outcomes are assumed to be independent of health and education outcomes. For the estimation of health outcomes, fitted values of water and sanitation are used and for the estimation of education outcomes fitted values of health are used in addition.[7]

Through an intensification of research on the MDGs, also the availability of data that better measure the outcomes of public service delivery for a relatively large number of countries has increased. For example, for education one no longer has to rely on enrolment rates, which tell little about the quality of education. The new indicator of the completion of primary education gives a much better picture of the outcome of primary schooling.[8] In addition youth literacy is used as an indicator of education outcomes. To measure health outcomes, the two widely used and available indicators of infant (aged 0 to 1 year) mortality rates and child (aged 0 to 5 years) mortality rates are used. The two indicators used for water and sanitation are access to improved water source and access

7 For these regressions only ordinary least squares were used. Gupta, Verhoeven and Tiongson (1999), who use a similar specification of the functions but without a system of equations, find very similar results using OLS and 2SLS regressions, indicating that reverse causality might not be a major problem here.

8 Primary completion rate is defined as the number of students successfully completing the last year of (or graduating from) primary school in a given year, divided by the number of children of official graduation age in the population (World Bank 2005).

to improved sanitation facilities as per cent of the population, as these are closely related to poverty reduction and part of the MDGs.[9]

To capture public expenditure in the different sectors, expenditure per student in primary education and health expenditure per capita are used.[10] Unfortunately no public expenditure data for water and sanitation were available. Likewise data for private expenditure on all three sectors were not available for a sufficient number of countries, so they could not be included here.

To capture the effect of aid, both the shares of ODA going to health, education and water and sanitation in total ODA as well as the share of total aid in GNI were used, as aid might be fungible. In addition, the share of budget aid in total aid has increased over the past decade and might also be used for public services. Aid data for 2000 are used, as the effect of aid is expected to occur with a lag. This also reduces problems of reverse causality. The volatility of aid (as per cent of GNI) was calculated as the coefficient of variation for total aid between 1980 and 2002.[11] There is some evidence that the volatility of aid differs by type of aid (project or programme) but no disaggregated aid volatility data were available (Fielding and Mavrotas 2005).

Several variables intended to measure the quality of institutions are included in the analysis:

— *Federalism at the state/province level*:[12] Decentralization is one approach to a better match of service delivery with the preferences of the people. However, there are many obstacles to decentralization especially in the developing countries because the tax base in rural areas is weak and vertical imbalances in technical and administrative capacities are large. It is expected that the decentralization variable can be of diverging importance for different services because the level of expertise needed varies (Bardhan 2002).

— *Freedom of the press*:[13] There is some evidence that asymmetric information plays an important role in public service delivery, as is shown in the Uganda

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9 If not stated otherwise, data are for 2002 from the World Bank World Development Indicators database (World Bank 2005). Data that more directly measure the quality of provision of water and sanitation like continuity of service or quality of water are not available for a large enough number of countries or refer only to groups of users such as urban areas or commercial users (see Estache and Goicoechea 2005).

10 As the biggest part of these expenditures is current expenditure for salaries, etc., data for the same year as the dependent variables (2002) are used.

11 ODA data are taken from OECD-DAC statistics (OECD 2006).

12 The variable used for decentralization is from the updated World Bank Database of Political Institutions (Beck et al. 2001). The indicator used is: Are the state/province governments locally elected?, taking the value 0 for no decentralization, 1 for some decentralization and 2 for decentralization.

13 The scores of freedom of the press produced by Freedom House (2005) are widely used by governments, international organizations, academics, and the news media in many countries. Countries are given a total score from 0 (worst) to 100 (best) on the basis of a set of 23 methodology questions divided into three subcategories. This is a modification to simplify the interpretation of results: new score = 100 – original score from Freedom House. Assigning numerical points allows for comparative analysis among the countries surveyed and facilitates an examination of trends over time.

example discussed above. Therefore countries with better media coverage should have more efficient public service provision. The freedom-of-press variable is highly correlated with voice and accountability, which measures various aspects of the political process, civil liberties, political and human rights.[14] It therefore captures the extent to which citizens of a country are able to participate in the selection of government. It is assumed that greater participation will lead to a better targeting of public services and thus to better outcomes.

— *Control over corruption*:[15] Corruption can affect the provision of public services through three channels, namely increase of prices and decrease of government output, reduced investment in human capital and thus shortage of inputs and reduction of government revenue. Corruption reduces spending on operations and maintenance. Previous research thus found a negative relationship between corruption and the provision of health care and education (Gupta, Davoodi and Tiongson 2000). The main characteristics that make the health sector vulnerable to corruption are the imbalance of information (e.g., between professionals and patients), uncertainty in health markets and complexity of the health systems (Transparency International 2006).

The socioeconomic control variables that are standard in the public service delivery literature include the following (Gupta, Verhoeven and Tiongson 1999; Rajkumar and Swaroop 2002):

— *Fertility*: If fertility is high, this implies a higher share of children in the population and thus higher costs for schooling. It also increases the health care costs for pregnant women and children. Thus it is expected that the coefficient is negative for both health and education outcomes.

— *Adult literacy rates*: Educated parents are more likely to be willing and able to send their children to school. Therefore a positive relationship is expected for education.

— *Population density*: Population density is expected to reduce the costs of service provision on a per capita basis. In addition, the costs to use the facilities in terms of transport costs and opportunity costs such as travel time are lower. Hence, population density should also be positively associated with all outcome indicators.

— *Prevalence of HIV*: The spread of HIV/AIDS,[16] which is most dramatic in Africa, puts a strain on the availability of qualified personnel especially in

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14 These data are from the World Bank project: Governance Matters (Kaufmann, Kraay and Mastruzzi 2005). The indicator is based on perceptions and ranges from -2.32 to 1.72 for 2002, with higher values representing higher accountability. The correlation coefficient between press freedom and voice and accountability is -0.94.

15 The corruption indicator is also taken from the World Bank project: Governance Matters (Kaufmann, Kraay and Mastruzzi 2005). The indicator is based on perceptions and ranges from -1.86 to 2.45 for 2002, with higher values representing higher control and thus less corruption.

16 This is measured as infected people as a share of the population aged 15-49.

education and health. In addition, it is expected to have a direct, negative impact on infant and child health.

— *Africa dummy*: As we are specifically interested in public service delivery in Africa where most of the MDGs are unlikely to be met, an Africa dummy is included. It is expected that it will have a negative coefficient.

— *Interaction terms*: The discussion above indicates that aid can have a positive outcome only if good institutions are in place. For example if corruption is high, it is likely that only a fraction of the sector aid will actually be spent for service delivery, while the remainder disappears (Rajkumar and Swaroop 2002). Therefore the different aid variables interact with press freedom and control of corruption.

A few variables commonly used in similar studies—like urbanization—were initially included in the analysis, but as they were not significant for any of the regressions, they were dropped. GDP per capita could not be included as it is highly correlated with other relevant variables such as health expenditure per capita and control of corruption. The correlation coefficient between the independent variables included in the regressions is less than 0.75. Thus multicollinearity among variables could affect the standard errors of coefficients to some extent. There are other potential determinants of public service outcomes that could not be included in the analysis due to a lack of data.[17] For example, child mortality is also influenced by other factors such as malnutrition. Only developing countries were included for the empirical analysis.[18]

5 Results

5.1 Water and sanitation

Table 2 reports the results of four OLS regressions for access to water and sanitation. The share of ODA that is allocated for water and sanitation does not have a significant coefficient in the different specifications. The exception is specification II-B where the coefficient is negative, implying that aid to water seems not to be effective. However, this result might be partly driven by the absence of available data on government and private sector spending in the sector. Likewise total aid as a percentage of GNI has a significant negative coefficient in specification II-A. Thus the impact of aid on the effectiveness of service delivery in these areas is limited, at best. This might also be attributed to the management problems and the increased costs associated with aid discussed above.

Surprisingly, the coefficient of aid volatility is positive and significant in three of the specifications. This result could be driven by the fact that water and sanitation expenditure is easier to adapt to changes in aid flows than expenditure in personnel intensive sectors, where expansion of services is associated with training. However, it

17 This might cause some problems of omitted variables.

18 See table of outcome indicators, ODA per sector and governance indicators for all countries, which is provided at the RWE homepage at www.uni-kiel.de/ifw/pub/wa/wa.htm.

could also be the case that the implementation of water and sanitation projects—which are often big and are carried out over a limited period—increases the volatility of aid disbursements.

The effect of governance on access to water and sanitation is also limited. As expected, press freedom has a positive coefficient, although it is significant only for access to water. This might again be due to the fact that the indicator is not specific for water and sanitation. Thus a positive association between access to information or voice and accountability and access to water and sanitation might exist, driven by improved accountability. The coefficient for control over corruption is not significant, but the interaction term between corruption and aid to water and sanitation has a positive significant coefficient for water (specification II-B), meaning that control of corruption does not have a direct effect on access to water, but that the efficacy of aid in improving access to water is positively related with control of corruption. This finding to some extent confirms the hypothesis that higher control of corruption can increase the effectiveness of aid.

Table 2
Regression results for access to water and sanitation (% of population)

	Ln sanitation		Ln water	
	I-A	I-B	II-A	II-B
Ln share of ODA for water and sanitation	0.013 [0.62]	0.030 [0.70]	-0.0007 [-0.08]	-0.018* [-1.65]
Ln aid as % of GNI	-0.007 [-0.28]	0.022 [0.62]	-0.020* [-1.87]	-0.002 [-0.13]
Coefficient of variation of aid (as % of GNI) over 1980-2002	0.005*** [2.58]	0.007*** [3.28]	0.0007 [0.77]	0.002*** [2.67]
Press freedom	0.004 [1.60]	0.005 [1.45]	0.002** [2.11]	0.002* [1.75]
Press freedom * Ln aid for water	0.0002 [0.52]	0.0005 [0.45]	0.0001 [0.05]	0.0002 [0.77]
Control over corruption index	-0.013 [0.13]	0.080 [0.70]	0.007 [0.17]	-0.014 [-0.28]
Control over corruption * Ln aid for water	-0.005 [-0.29]	0.001 [0.04]	0.003 [0.46]	0.017* [1.91]
Fertility rate	-0.230*** [-5.80]	-0.247*** [-4.16]	-0.111*** [-6.72]	-0.133*** [-5.75]
Population density	0.0001 [0.60]	0.0002 [0.88]	0.0002** [2.04]	0.0002 [1.49]
Africa dummy	-0.058 [-0.56]	-0.014 [-0.14]	0.046 [0.83]	0.047 [0.73]
Federalism, provincial level		-0.053 [-0.93]		-0.059* [-1.86]
Constant	4.666*** [30.93]	4.678*** [21.25]	4.749*** [58.22]	4.761*** [45.36]
No. of observations	109	71	110	72
Adjusted R-squared	0.5477	0.5604	0.5154	0.5483
F-statistic	11.29***	6.73***	13.16***	6.47***

Note: For all regressions white's heteroscedasticity-corrected t-statistics are shown in parenthesis. *** indicate significance at the 1 per cent level, ** significance at the 5 per cent level and * significance at the 10 per cent level.

Source: Author's calculations.

The level of federalism at the provincial level is included only in two specifications (I-B and II-B) as it reduces the number of observations considerably. It has a negative association with access to water and sanitation, which is significant only in the case of water. This implies that decentralization is not a panacea for pro-poor development and public service provision, especially as its implementation is often sketchy, as discussed above. If economies of scale and network externalities exist—as in the case of infrastructure—central planning might lead to better outcomes.

The fertility rate is negatively associated with both access to sanitation and water, as expected. In addition, population density has a positive association with water and sanitation, with a significant coefficient in specification II-A, as it is more cost effective to provide network infrastructure if population density is high. The coefficient for the African dummy is negative for sanitation and positive for water, but never significant. This indicates that the low performance of African countries can be explained by the other independent variables. For the fitted values for water used in the following regressions, specification II-A was chosen because the number of observations was much higher than in II-B.[19]

5.2 Health

The results for four OLS regressions of health outcomes are reported in Table 3. The per capita health expenditure has a negative coefficient, which is significant in two specifications, indicating that higher health expenditure reduces infant and child mortality in line with the reviewed literature (Gupta, Verhoeven and Tiongson 1999; Rajkumar and Swaroop 2002; World Bank/IMF 2005). Likewise the share of ODA for health has a significant negative coefficient for child mortality, which indicates that aid in this area seems to be effective. However, the coefficient for the share of ODA in GNI is positive and significant in all cases, meaning aid could worsen health outcomes as in the case of water and sanitation because of its macro effects. The coefficient for the volatility of aid is significant and negative in specifications III-B, IV-A and IV-B, implying that higher volatility reduces child mortality. This result is similar to that for water and sanitation and might also be explained by the use of volatility of total aid. In addition, aid for health has been increasing in line with the focus on reaching the MDGs, so volatility could be associated with an increase in funding.

Access to water has a positive and significant coefficient in three of the four specifications, contradicting the hypothesis that access to water should lower infant and child mortality. This is despite the fact that the correlation between the fitted values for access to water and health outcomes has a significant coefficient of -0.78 for ln infant mortality and -0.80 for ln child mortality. One explanation for this result could be that both sectors compete for funds. Rajkumar and Swaroop (2002) also find positive coefficients for access to safe water in some of their regressions with a similar specification, but these coefficients are not significant.

19 The relatively low R-squared in Table 2 are probably due to the lack of data on public spending on water and sanitation.

Table 3
Regression results for health indicators

	Ln infant mortality		Ln under 5 mortality	
	III-A	III-B	IV-A	IV-B
Ln health expenditure per capita	-0.200*** [-2.63]	-0.129 [-1.34]	-0.267** [-2.54]	-0.171 [-1.51]
Ln share of ODA for health	-0.105 [-1.56]	-0.105 [-1.56]	-0.137* [-1.87]	-0.169** [-2.04]
Ln aid as % of GNI	0.109* [1.71]	0.156** [2.22]	0.204** [3.17]	0.229*** [3.62]
Coefficient of variation of aid (as % of GNI) over 1980-2002	-0.003 [-1.48]	-0.004* [-1.88]	-0. 060** [-2.24]	-0.009*** [-3.20]
Access to water (% of population) fitted values	1.962 [1.51]	3.025** [2.41]	4.306** [2.62]	4.794*** [3.17]
Control over corruption index	-0.368* [-1.86]	-0.281 [-1.18]	-0.162 [-0.64]	0.012 [0.03]
Control over corruption * Ln share of ODA for health	-0.010 [-0.14]	-0.062 [-0.66]	-0.001 [-0.01]	-0.111 [-0.95]
Fertility	0.314** [2.06]	0.451** [2.52]	0.640** [3.70]	0.735*** [4.61]
Population density	-0.0003 [-1.03]	-0.0003 [-0.74]	-0.0005 [-1.17]	-0.0003 [-0.51]
HIV/AIDS	0.029*** [6.21]	0.030*** [6.02]	0.017* [1.76]	0.016 [1.59]
Federalism, provincial level		0.052 [0.85]		0.096* [1.62]
Constant	-4.645 [-0.76]	109.58 [0.87]	-14.755* [-1.99]	237.03 [1.20]
Number of observations	63	50	62	50
Adjusted R-squared	0.7926	0.8297	0.8088	0.8482
F-statistic	34.54***	35.01***	31.28***	23.16***

Note: For all regressions White's heteroscedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level, ** significance at the 5 per cent level and * significance at the 10 per cent level. Independent variables related to education were also included in the regression, due to the structure of the system of equations, but are not reported here.

Source: Author's calculations.

The control-over-corruption index does have a negative coefficient, which is significant in specification III-A, meaning that greater control of corruption could reduce infant mortality. However, interacted with the share of ODA for health the coefficients are not significant, meaning that beyond the direct effect control of corruption seems not to increase the efficacy of aid.[20]

The federalism index is again only included in two specifications and has a significant positive coefficient for child mortality. This result might be due to the fact that the capacity and resources at the provincial and local level to provide adequate services is insufficient as discussed above.

20 The press freedom variables as well as the African dummy were dropped from the regressions as they were not significant and as the number of observations was reduced for the regressions on health and education.

Higher fertility is positively associated with infant and child mortality, as it increases the cost of service delivery, which is in line with the results by Rajkumar and Swaroop (2002). Population density has a negative coefficient, which is however not significant in any of the specifications. The prevalence of HIV increases infant and child mortality as expected.

5.3 Education

The results of the four OLS regressions for education are reported in Table 4. The coefficient for public expenditure per student is always negative but significant only in specification V-A, indicating that expenditure per student does not increase education outcomes. This is in line with previous results, for example, by Rajkumar and Swaroop (2002).

Table 4
Regression results for education indicators

	Ln primary completion rate		Ln youth literacy	
	V-A	V-B	VI-A	VI-B
Ln expenditure per student on primary education	-0.123* [-2.14]	-0.112 [-1.63]	-0.046 [-1.25]	-0.034 [-1.24]
Ln share of ODA for primary education	0.059** [2.40]	0.038 [1.27]	0.027* [1.65]	0.011 [0.93]
Ln aid as % of GNI	-0.030 [-1.58]	-0.038* [-1.68]	-0.032** [-2.26]	-0.041*** [-2.74]
Coefficient of variation of aid (as % of GNI) over 1980-2002	-0.002** [-2.05]	-0.002 [-1.51]	0.001** [2.36]	0.001 [1.65]
Access to water (% of population) Fitted values	-0.959* [-1.90]	-1.132** [-2.18]	-1.097*** [-3.06]	-1.282*** [-2.67]
Infant mortality Fitted values	-0.033 [-0.53]	-0.043 [-0.55]	-0.067* [-1.68]	-0.052 [-1.28]
Control-over-corruption index	0.095* [1.64]	0.055 [0.82]	0.076* [1.92]	0.037 [1.20]
Control over corruption * share of ODA for primary education	-0.009 [-1.23]	-0.011 [-1.32]	-0.005 [-1.02]	0.005 [1.46]
Fertility	-0.229*** [-3.20]	-0.272*** [-3.72]	-0.137*** [-2.77]	-0.154** [-2.16]
Population density	-0.0001 [-0.64]	-0.0001 [-0.28]	0.0002 [1.26]	0.0002* [1.84]
Literacy rate, adult	0.007*** [2.99]	0.004* [1.81]	0.012*** [7.07]	0.011*** [7.26]
Federalism, provincial level		0.006 [0.19]		0.0007 [0.03]
Constant	9.227*** [3.73]	10.363*** [4.06]	8.480*** [5.21]	9.529*** [4.43]
No. of observations	52	41	52	41
Adjusted R-squared	0.8362	0.8242	0.8779	0.8973
F-statistic	11.87***	15.04***	9.24***	12.49***

Note: For all regressions White's heteroscedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level, ** significance at the 5 per cent level, and * significance at the 10 per cent level.

Source: Author's calculations.

In contrast, the share of ODA for primary education is positive and significant for two specifications implying that aid for education has a positive impact on both primary completion rate and youth literacy. The coefficient for aid as a share of GNI is negative and significant in three cases, similar to the results for water and sanitation and health. The coefficient for the volatility of aid is negative and significant for primary completion rate (V-A), meaning that higher aid volatility might reduce the efficiency of education, as discussed above. However the coefficient for aid volatility is positive and significant for youth literacy (VI-A), which might be explained by similar factors as in the case of health.

Contrary to expectations, access to water has a significant negative association with education outcomes similar to the findings for health. Infant mortality has a negative coefficient, which is significant only in specification VI-A for youth literacy, indicating that better health also improves education outcomes, as expected.

Governance seems to be more important for education than for health. Controlling for corruption seems to improve education outcomes with significant coefficients for two specifications. However, as in the case of health, the interaction term between control over corruption and share of ODA is not significant. Thus controlling for corruption seems to have a direct effect on education.

Federalism at the provincial level does not seem to have any effect on education outcomes, probably because positive effects of the decisionmaking being closer to the recipients and negative effects of local-level capacity and financial problems offset each other. The coefficients of the other control variables are as expected, with a negative significant association for fertility and a positive significant association for adult literacy.

6 Conclusions

Overall, the share of ODA provided for education and health seems to have a positive impact on outcomes in these sectors. However, total aid seems to be negatively associated with outcomes in these sectors, whereas aid volatility is associated with better outcomes in sanitation, water and infant mortality. It seems that the negative effect of aid volatility with respect to public service outcomes is either more difficult to capture or less damaging than expected. Future research also using private expenditure on education, health and water and sector specific volatility of aid and other expenditure once the data become available will be useful to clarify some of the unexpected results.

The results presented above could imply that although aid targeted to specific sectors and targets might have positive effects, a general increase in aid could create additional problems with respect to Dutch disease, less accountability of governments towards local populations, and more opportunities for corruption. Overall, aid cannot be the only solution for improved service delivery to meet the MDGs because of its mixed impact.

With respect to institutions and governance, the results are also mixed. Press freedom, which is highly correlated with voice and accountability, seems to have a positive association with access to water. Control of corruption is positively associated with outcomes in health and education. Thus an improvement in these areas is likely to

reduce the financing needed for reaching the MDGs. Decentralization is negatively associated with access to water and reduction of child mortality. This might indicate that there is a considerable lack of capacity at the local level, which needs to be addressed first before the potential positive effects of decentralization like better targeting and accountability can materialize.

The results of this paper make it clear that although some similarities exist between the different sectors, there are also important differences with respect to the effects of better governance and decentralization. In particular, decentralization cannot be regarded as a fast track to circumvent unresponsive central governments. Rather, capacity has to be built at the local level together with creating local revenue and delegating decisionmaking. A relatively high share of aid relative to total government spending also means that these processes are often influenced by donors, and that influence might reduce flexibility. Further research about how different aid modalities and different institutional settings influence public service outcomes at the country level is therefore needed.

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Annex

Annex Table
Selected indicators on infrastructure, health, education, aid, corruption and press freedom, 2002

	Access to:						Share of ODA for:				
	Sanitation	Improved water	Infant mortality	Under 5 mortality	Youth literacy	Primary completion rate	Water	Health	Education	Control of corruption index	Press freedom index
Albania	89	97					20.18	4.75	8.27	-0.83	48
Algeria	92	87	36	43	90	96	0.08	0.93	46.75	-0.72	62
Angola	30	50					2.66	11.74	5.95	-1.17	79
Antigua & Barbuda	95	91					0.00	0.00	4.74	0.84	44
Argentina			17	20	99	103	0.08	1.45	18.16	-0.78	37
Armenia	84	92	32	35	99	103	1.10	3.68	2.76	-0.69	60
Azerbaijan	55	77	76				8.30	3.60	1.43	-1.04	77
Bahrain			12	15	99	100	0.00	7.05	59.03	0.96	75
Bangladesh	48	75					5.32	9.70	4.32	-0.95	63
Barbados	99	100	11	13	100	110	0.00	0.00	2.59	1.29	16
Belize	47	91	33	40	90	89	0.00	8.68	7.63	-0.24	24
Benin	32	68	93	158	56	51	6.99	5.02	7.51	-0.52	30
Bolivia	45	85	56	70	96	102	5.61	4.51	3.20	-0.82	72
Bosnia & Herzegovina	93	98					1.95	1.23	3.49	-0.61	53
Botswana	41	95	78	107	89	91	0.00	0.96	3.82	0.80	30
Brazil	75	89	34	37	95	112	1.06	0.68	17.45	-0.06	32
Burkina Faso	12	51					7.50	1.82	3.73	0.13	39
Burundi	36	79	114	190	66	31	0.33	1.86	1.27	-0.98	77
Cambodia	16	34	96	137	80	69	0.15	4.36	2.91	-0.95	68
Cameroon	48	63					1.11	8.26	15.22	-1.04	68
Cape Verde	42	80					0.71	1.44	12.86	0.46	30
Chad	8	34					7.11	16.33	1.87	-0.94	74
China	44	77					23.32	1.51	3.18	-0.35	80
Colombia	86	92	19	22	97	88	0.01	0.64	1.23	-0.51	60
Comoros	23	94					0.00	4.47	21.18	-0.92	41
Congo, Dem. Rep.	29	46					0.74	12.93	7.41	-1.42	86
Congo, Rep.	9	46	81	108	98	47	0.76	2.97	24.77	-1.02	53
Costa Rica	92	97	9	11	98	94	1.21	6.41	4.44	0.91	17
Côte d'Ivoire	40	84	116	190			0.16	0.75	7.15	-0.92	66
Croatia			6	7	99	94	0.24	0.76	14.39	0.25	33
Djibouti	50	80					1.67	4.01	30.21	-0.72	67
Dominica	83	97					0.00	0.00	1.39	0.54	16
Dominican Republic	57	93	31	37	92	94	9.93	1.22	8.26	-0.40	30
Ecuador	72	86	25	29	97	100	21.11	1.64	3.04	-1.00	40
Egypt, Arab Rep.	68	98					2.76	2.33	5.45	-0.28	77
El Salvador	63	82	33	38	89	86	1.77	9.12	6.88	-0.49	35
Equatorial Guinea	53	44					0.33	17.95	33.52	-1.86	80
Eritrea	9	57	49	90			0.10	16.03	11.75	-0.09	79
Ethiopia	6	22					0.66	1.85	4.78	-0.32	61
Gabon	36	87	90	91			0.00	2.19	22.89	-0.52	52
Gambia, The	53	82	91	125			0.48	2.33	25.91	-0.74	65

Annex Table con't

Annex Table (con't)
Selected indicators on infrastructure, health,
education, aid, corruption and press freedom, 2002

	Access to:						Share of ODA for:				
	Sanitation	Improved water	Infant mortality	Under 5 mortality	Youth literacy	Primary completion rate	Water	Health	Education	Control of corruption index	Press freedom index
Georgia	83	76					0.19	1.77	3.57	-1.03	53
Ghana	58	79					5.36	4.74	2.43	-0.39	27
Guinea	13	51	108	167			5.70	13.46	19.06	-0.66	74
Guinea-Bissau	34	59					0.37	1.46	5.70	-0.59	56
Guyana	70	83	53	71			19.68	0.19	1.60	-0.48	23
Honduras	68	90					9.97	0.56	1.29	-0.76	43
India	30	86	65	90	72	81	5.80	23.02	16.17	-0.36	42
Indonesia	52	78	33	44	98	95	0.66	9.96	5.26	-1.15	53
Iran, Islamic Rep.	84	93	34	41	94	106	0.00	0.49	32.04	-0.36	75
Jamaica	80	93	17	20	94	89	10.72	1.62	15.23	-0.45	17
Jordan	93	91					22.01	3.36	2.43	0.04	60
Kazakhstan	72	86	63	73	100	102	1.86	0.94	2.33	-1.06	69
Kenya	48	62					1.42	9.54	3.58	-1.09	67
Kiribati	39	64					0.00	0.49	36.52	0.20	21
Kyrgyz Republic	60	76	59	69			0.10	0.85	1.06	-0.83	68
Lao PDR	24	43	86	98	79	73	11.96	12.68	12.08	-0.97	82
Lebanon	98	100	27	31			1.70	4.23	26.49	-0.37	74
Lesotho	37	76	78	107	90	67	6.13	15.99	8.53	-0.18	46
Liberia	26	62					0.16	22.23	5.38	-1.30	77
Madagascar	33	45	81	130			2.21	1.98	5.37	0.05	31
Malawi	46	67					1.40	4.91	22.75	-0.85	54
Malaysia		95	7	8	97	92	39.92	0.00	0.45	0.36	71
Maldives	58	84					0.00	0.49	59.67	-0.05	61
Mali	45	48	123	222	30	39	1.35	3.94	13.79	-0.11	23
Mauritania	42	56					0.62	1.57	5.82	0.20	61
Mauritius	99	100					19.25	1.48	42.12	0.49	17
Moldova	68	92	26	32	100	83	0.23	27.14	2.09	-0.90	59
Mongolia	59	62	58	71	98	108	0.08	5.40	7.24	0.11	31
Morocco	61	80	39	42	70	68	27.31	8.12	20.73	-0.05	58
Mozambique	27	42					2.71	7.59	4.46	-0.84	48
Namibia	30	80	49	67	92	90	1.64	1.50	23.78	0.16	34
Nepal	27	84	65	89	63	78	14.58	4.69	5.64	-0.37	60
Nicaragua	66	81	32	40	80	75	11.96	5.00	8.83	-0.46	32
Niger	12	46	157	266	24	21	4.69	1.54	3.17	-1.06	49
Nigeria	38	60					5.54	9.32	12.33	-1.32	57
Oman	89	79	11	13	99	73	0.24	3.05	4.57	1.00	68
Pakistan	54	90					0.28	6.21	2.60	-0.81	57
Panama	72	91	19	25	97	98	3.89	5.67	12.44	-0.24	30
Papua New Guinea	45	39	69	94			1.40	19.38	18.18	-0.75	26
Paraguay	78	83	25	30	97	93	0.33	0.64	6.72	-1.20	51
Peru	62	81	29	38	97	98	41.51	2.35	2.21	-0.23	30

Annex Table con't

Annex Table (con't)
Selected indicators on infrastructure, health, education, aid, corruption and press freedom, 2002

	Access to:						Share of ODA for:				
	Sanitation	Improved water	Infant mortality	Under 5 mortality	Youth literacy	Primary completion rate	Water	Health	Education	Control of corruption index	Press freedom index
Philippines	73	85	28	38	95	98	1.25	3.52	1.67	-0.50	30
Rwanda	41	73	118	203	85	37	1.38	3.65	10.32	-0.34	87
Sao Tome & Principe	24	79					7.12	8.68	8.17	-0.31	19
Senegal	52	72	19	138	53	48	1.20	1.65	14.75	-0.19	39
Sierra Leone	39	57					0.97	9.83	0.48	-0.79	62
Solomon Islands	31	70					1.48	16.08	6.11	-1.58	24
South Africa	67	87	52	65	92	99	1.40	3.58	16.90	0.35	23
Sri Lanka	91	78					7.46	8.55	17.46	-0.13	63
St Kitts and Nevis	96	99					0.00	0.00	0.16	0.41	18
St Lucia	89	98					1.45	0.00	0.81	0.41	11
Sudan	34	69					0.96	4.34	3.58	-1.03	87
Suriname	93	92					0.71	19.06	3.75	0.19	25
Swaziland	52	52	101	146	91	75	0.21	0.81	1.88	-0.30	77
Syrian Arab Republic	77	79	17	20	95	88	17.67	0.62	31.92	-0.28	78
Tajikistan	53	58	78	97	99	100	0.05	7.99	2.96	-1.07	80
Tanzania	46	73					1.89	3.91	2.33	-0.97	49
Thailand	99	85	24	27	98	86	9.17	0.11	0.99	-0.28	30
Timor-Leste	33	52					0.79	0.63	3.06	-0.52	21
Togo	34	51	79	141	77	78	0.40	14.63	11.70	-0.68	68
Tonga	97	100					57.35	0.47	4.18	-0.73	36
Tunisia	80	82	20	26	94	99	13.48	0.27	20.57	0.44	73
Turkey	83	93					9.99	0.05	30.71	-0.40	58
Turkmenistan	62	71					0.12	5.50	5.24	-1.21	91
Uganda	41	56					2.55	10.77	8.14	-0.92	42
Uruguay	94	98	13	15	99	95	0.00	0.33	22.82	0.81	25
Uzbekistan	57	89					1.86	15.62	9.08	-1.03	84
Vanuatu	50	60					0.00	7.96	19.56	-0.83	24
Venezuela, RB	68	83					1.13	0.42	14.91	-0.94	44
Vietnam	41	73					5.75	1.59	5.52	-0.67	82
Zambia	45	55	102	182	89	60	6.15	2.88	1.03	-0.91	65
Zimbabwe	57	83	75	12	98	81	1.11	14.67	6.52	-1.22	83

Note: The countries for which the respective dependent variable is reported here were included in the regression analysis in this paper.

Source: World Bank (2005); OECD (2006); Freedom House (2005).